PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
TS 1406 PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2004/051322	01.07.2004	01.07.2003

International Patent Classification (IPC) or national classification and IPC
C10G9/00, C10G51/02

Applicant
SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
27.04.2005	14.06.2005

Name and mailing address of the international preliminary examining authority:

European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized Officer

Gilliquet, J-N

Telephone No. +31 70 340-4573

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/051322

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1, 2, 4, 5, 8-11	as originally filed
3, 3a, 6, 7	received on 04.04.2005 with letter of 04.04.2005

Claims, Numbers

1-8	received on 04.04.2005 with letter of 04.04.2005

Drawings, Sheets

1/2-2/2	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-8
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-8
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-8
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

The following document (D) is referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: WO 98 10036 A (MYRSTAD TROND ;SAXVIK MORTEN (NO); NORSKE STATS OLJESELSKAP (NO)) 12 March 1998 (1998-03-12)

1. Novelty and inventive step of independent claim 1

1.1 Document D1, which is considered to represent the most relevant state of the art, discloses a process for improving the transportability of a heavy oil, wherein a part of the heavy oil to be transported is separated out and is degraded to a more liquid substance, which is then mixed with the remaining heavy oil, characterized thereby that the separated part of the heavy oil, in mixture with added solid particles, is upgraded to a more liquid oil by being cracked in a hammer mill type of apparatus, in which the heat required for the cracking is supplied mechanically, and the treated oil, before being mixed with the remaining heavy oil, is subjected to a separation so as to separate out at least a substantial part of its content of solid particles (see claim 1 of D1).

1.2 The subject-matter of present independent claim 1 differs from D1 in that the separated bitumen feed is distilled and only the residual fraction is thermally cracked. The thermally cracked fraction is further distilled and the light fractions are added to the crude oil. The heavy fraction is used for generation of power and/or heat.

1.3 The technical effect of these distinguishing features is not clearly established in view of the process of Document D1.

1.4 The problem to be solved by the present invention may therefore be regarded as how to provide an alternative process for the production of pipeline transportable crude.

1.5 None of the documents on file discloses these distinguishing features nor gives a hint of their effect.

1.6 The subject-matter of independent claim 1 can therefore be considered as new in the sense of Article 33(2) PCT and as involving an inventive step (Articles 33(3) PCT).

2. Dependent claims

2.1 Claims 2-8 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

The thermal cracking may be done by a furnace cracking process, but is preferably a soaker visbreaking process. In the soaker visbreaking process the feed is heated to a temperature suitably between 420 and 500 °C, preferably between 440 and 480 °C, followed by further conversion in a soaker vessel. The residence time is suitably between 0.5 and 2 hours. The conversion obtained may be between 4 and 14 wt% of the material boiling above 510 °C, preferably between 8 and 12 wt%. In the case of furnace cracking the temperature is suitably between 440 and 510 °C, preferably between 480 and 500 °C, the pressure is suitably between 5 and 50 bar, preferably between 15 and 20 bar and the residence time is suitably between 1 and 15 minutes.

The product of the thermal cracking process is fed to a fractionator, preferably an atmospheric fractionator. Here the product is separated into two or more fractions. The light fraction suitably has a boiling point below 350 °C, but up till 380 °, or even 410 °C is possible. The heavy fraction may be used for the generation of power and/or heat, or, preferably, is sent to a vacuum distillation unit, preferably a vacuum flash unit. In the latter option an intermediate stream is obtained boiling between the boiling point of the light fraction and suitably at least 450 °C, preferably 510 °C, more preferably 600 °C. The very heavy fraction obtained in this way is used for the generation of power and/or heat. The intermediate fraction may be used as blending component for the pipeline-transportable crude oil.

In another embodiment of the invention the product of the thermal cracking process is first send to vapour liquid cyclone. The vapour product, at least comprising the compounds boiling below 400 °C, is then sent to the

tar sands). The viscosity is usually above 10,000 cps at reservoir temperature. These feeds may be produced from oil fields containing such heavy crudes, but suitable sources are shale oil and, especially, tar sands. Tar sands occur in a number of places, notably Northern Canada (Athabasca tar sands) and Venezuela (Orinoco tar sands). A suitable separation between sand and oil may be carried out by hot water extraction (hot water extraction, steam/hot water injection). The amount of asphaltenes in the feed is very high.

The pipeline-transportable crude oil as described may have to be transported over distances up till 1000 km or even above, usually up till 500 km. The viscosity usually will be up till 500 cSt (@ 37.8 °C), preferably up till 250 cSt, more preferably up till 100 cSt.

The division of the total feed into the two fractions is suitably carried out in such a way that the first fraction is as small as possible while still a pipeline-transportable syncrude is obtained. It will be appreciated that the result will depend on the actual composition of the bitumen feed. A suitable division is between 20 and 80 wt% of the total feed for the first fraction, preferably between 30 and 70 wt%, more preferably between 40 and 60 wt%, of the total feed.

Distillation of the first fraction is carried out by conventional means. Atmospheric distillation in combination with vacuum distillation may be used. Also high vacuum flashing technology may be used. The light fraction suitably contains all components boiling below 380 °C, preferably al components boiling up till 450 °C, more preferably up till 510 °C. Using high vacuum flash technology, the light fraction may contain all components boiling up till 600 °C.

been invested in this very part of the refinery. As mentioned above, it is known to use solvents to transport heavy bituminous crudes, however, the use of the solvents (or diluents) usually implies that the solvent has to be returned to the production place.

A possible solution for the above problem is to separate the heavy bituminous crude into a light and a heavy fraction and to thermally crack (e.g. by means of visbreaking) the heavy fraction after which all liquid products are blended into a "synthetic" crude. This synthetic crude has a lower viscosity and a lower residue (expressed as >510 °C) content. Such processes are known in the art. For example, in WO 98/10036 a process is described wherein part of a heavy oil to be transported is separated out and is degraded to a more liquid substance. The separated part of the heavy oil is then subjected to a cracking process. The drawback of such a scheme is that the asphaltenes in the thermally cracked residue have a lower stability, so when blending back the lighter part of the crude into the total liquid product of the thermal cracker, stability problems may occur because of the poor peptizing power (aromaticity or solvency) of these light fractions. This may result in a situation in which only restricted residue conversion is possible, which in its turn will result in insufficient viscosity reduction.

3. Summary of the invention

In the present process, now, it is proposed to separate a heavy bituminous feed into two parts, whereafter the first part of the feed is separated into a light fraction and a heavy fraction, which heavy fraction is thermally cracked and separated in a second light fraction and a residual fraction, followed by mixing the

two light fractions and the second part of the feed into a pipeline-transportable crude oil, while the thermally cracked heavy fraction is used for the generation of power and/or heat. In this way a minimum upgrading is done at the source of the crude oil. This usually is an

CLAIMS

1. Process for the production of a pipeline-transportable crude oil from a bitumen feed, comprising;
(1) dividing the bitumen feed into two fractions, the first fraction comprising between 20 and 80 wt% of the feed, the second fraction comprising between 80 and 20 wt% of the total feed, (the two fractions together forming 100 wt % of the feed),
(2) distillation of the first fraction obtained in step (1) (preferably under vacuum) into a light fraction boiling below 380 °C (preferably the 450- °C fraction, more preferably the 510- °C fraction) and a residual fraction,
(3) thermal cracking (of at least part of, preferably all of,) the residual fraction obtained in the distillation process described in step (2),
(4) distillation of the product obtained in step (3) into one or more light fraction(s) (boiling below 350 °C), optionally one or more intermediate fractions (boiling between 350 and 510 °C) and a heavy fraction (boiling above at least 350 °C),
(5) combining the second fraction obtained in step (1), the light fraction obtained in step (2) and the light fraction(s) obtained in step (4) to obtain a pipeline-transportable crude oil, and
(6) using the heavy fraction obtained in step (4) for the generation of power and/or heat.

2. Process according to claim 1, in which the bitumen feed in step (1) is divided into two fractions, the first fraction comprising between 40 and 60 wt% of the feed and

the second fraction comprising between 60 and 40 wt% of the total feed, (the two fractions together forming 100 wt% of the feed).

3. Process according to claim 1 or 2, in which the thermally cracked product is split by distillation into a light fraction (boiling below 350 °C), an intermediate fraction (boiling between 350 and 510 °C) and a heavy fraction (boiling above 510 °C).

4. Process according to claim 3, in which (at least part of, preferably all) the intermediate fraction is also added to the pipeline-transportable crude oil of step (5).

5. Process according to claim 4, in which the intermediate fraction is thermally cracked, followed by distillation in a light product and a heavy product, the light product being added to the pipeline-transportable crude oil mentioned in step (5), and the heavy fraction preferably used in the generation of power and/or heat as described in step (6).

6. Process according to any one of claims 1 to 5, in which the thermal cracking in step (3) is carried out at a temperature between 440 and 510 °C and a pressure between 5 and 50 bara.

7. Process according to any one of claims 1 to 5, in which the thermal cracking in step (3) is carried out in a soaker vessel.

8. Process according to claim 7, in which the thermal cracking is carried out at a temperature between 420 and 500 °C and a pressure between 2 and 20 bara.

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